

COMPARISON AND CONTRAST OF TRACE ELEMENTS IN CRUDE SHALE OILS AND PETROLEUM

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The abundances and chemical forms of a large group of elements including the trace metals As, Co, Fe, Mo, Ni, Se, V and Zn were determined in three whole and fractionated shale oils obtained from Colorado and Utah oil shale reserves. The crude shale oils were representative product oils from an above-ground, a modified in-situ, and a true in-situ retorting process and were produced by pilot plant or larger sized facilities. Elemental abundances were determined by several modern analytical techniques including instrumental neutron activation analysis, energy dispersive X-ray fluorescence analysis, prompt γ -ray activation analysis, and plasma emission spectrometry. The analyses were compared to identify major differences between elemental partitioning yields of the various retorting technologies and were further compared and contrasted with reported elemental concentrations in petroleum. The elements As and Fe were found to be the most prominent trace metals in the shale oil matrix and As and Se levels were observed to be 1 to 2 orders of magnitude greater than those reported for petroleum.